Message

From: Liljegren, Jennifer [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=C7098A838CD34F75B8878571FE95D939-JLILJEGR]
Sent: 4/6/2018 7:46:50 PM
To: D'Agostino, Kathleen [dagostino.kathleen@epa.gov]; Rosenthal, Steven [rosenthal.steven@epa.gov]
CC: Svingen, Eric [Svingen.Eric@epa.gov]
Subject: FW: Is there a technical basis to Wisconsin's recommendation?
Attachments: RTC draft_4.2.18.docx

Hi Eric,

I wanted to let you know I am forwarding this to Kathleen since we have been discussing this as well. I am also cc'ing Steve, since some of this information may aid in his write-up for the Michigan areas.

Jenny

From: Liljegren, Jennifer
Sent: Friday, April 06, 2018 2:45 PM
To: Svingen, Eric
Subject: RE: Is there a technical basis to Wisconsin's recommendation?

Eric,

I have reviewed the material from Wisconsin, and I have drawn the same conclusion that you have. I do not see a credible technical basis for utilizing Wisconsin's statewide power-fit curve (70 ppb contour) distance from shoreline approach for designating nonattainment areas in Wisconsin. Wisconsin suggests that precursor emissions originating in the state of Wisconsin are not forming meaningful amounts of ozone in the state of Wisconsin. There is no credible evidence to support this.

I definitely did not use Wisconsin's best-fit 70 ppb contour as a justification for shrinking Sheboygan from the historical full county nonattainment area to a partial county nonattainment area. Instead, I relied on a synthesis of the 5-factor analysis with special consideration of the two sets of monitoring data in Sheboygan County in conjunction with Wisconsin's lake breeze inland penetration distance analysis specific to the Sheboygan County monitors, which if you remember, we discussed and determined that Wisconsin's lake breeze inland penetration distance analysis specific to the Kenosha County monitors was not appropriate for use in justifying a Kenosha partial county portion of the Chicago area, given, among other things, the information you laid out in your email below regarding the two violating monitors in Kenosha County, the design values of the farther inland monitors, the proximity to Chicago, etc.

Keep in mind, for the Sheboygan-specific lake breeze inland penetration distance analysis, Wisconsin reasoned that during deep lake breeze events, the lower ozone concentrations at the inland monitor likely resulted from dilution of ozone-rich air via mixing with less ozone-rich overlying air as the air moved inland from the lakeshore. I consider this reasoning to be consistent with the conceptual model of Lake Michigan ozone formation and transport developed by Dye et al. as a result of the aircraft and ground-based monitoring data collected during several high ozone episodes which occurred over the course of the Lake Michigan ozone study during the summer of 1991. Dye et al. indicate that when ozone-rich air from over the lake flowed downwind to onshore locations, air with the highest ozone concentrations mixed down to the surface first, causing the highest ozone observations along the shoreline. Eventually air from higher altitudes mixed down to the surface farther inland, but ozone in these air masses had lower concentrations.[1]

[1] Dye, T. S., Roberts, P. T., and Korc, M. E.: Observations of transport processes for ozone and ozone precursors during the 1991 Lake Michigan Ozone Study, J. Appl. Meteorol., 34, 1877-1889, 1995.

I am attaching my draft response to comments (RTC) document, which contains information detailing the rationale for the Sheboygan partial county area, the reasoning for which was extended to Manitowoc County, which despite having a second monitor, is close enough in proximity and other characteristics to Sheboygan County, that I did not feel too uncomfortable extending a similar partial county area determination for Manitowoc County.

This document also includes information regarding the Milwaukee area that might be helpful.

Definitely I agree with you that Wisconsin' best-fit line (70 ppb contour) has no legitimate technical basis and that we should not be using it to defend our intended nonattainment areas when finalized or if finalized in any way differing from our original 120-day proposal. I think that Wisconsin's best-fit line (70 ppb contour) is misleading. To people not familiar with the basic science of ozone formation and transport, particularly in areas subject to lake breeze meteorology like these Wisconsin areas along Lake Michigan, I think this information could be very confusing. Wisconsin's best-fit line (70 ppb contour) misrepresents and oversimplifies the apparent tendency of ozone design values measured at the monitors to decrease as one moves inland from the shoreline. There are many factors and variables that must be considered, in particular the magnitude of local and regional precursor emissions and the meteorology transporting them to nearby local and regional downwind areas.

I hope this helps. Please let me know if you would like to discuss further.

Jenny

Jenny Liljegren, PhD
Physical Scientist
Attainment Planning and Maintenance Section
U.S. EPA Air and Radiation Division - Region 5

From: Svingen, Eric
Sent: Thursday, April 05, 2018 4:45 PM
To: Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>
Subject: Is there a technical basis to Wisconsin's recommendation?

Hi Jenny -

I'm trying to better understand the technical basis of Wisconsin's 20 April 2017 letter, which proposes a nonattainment "contour" in Kenosha County extending 4.2 miles from the Lake Michigan shoreline. I know you have spent a huge amount of time considering Wisconsin's similar recommendations for counties further north, so I wonder if you can answer a few questions and clarify my thoughts regarding Kenosha.

Wisconsin's recommendation (to be precise, this is a fallback recommendation, should EPA not designate the entire state attainment) rests on calculations explained on pages 44 through 50 of its letter. EPA is required to designate as nonattainment all areas violating the NAAQS or contributing to a violation; Wisconsin discards the possibility that Wisconsin contributes to its own violations, and focuses on determining the spatial extent of the air that violates the NAAQS.

To calculate this area, Wisconsin uses a "distance inland" approach; this assumes that ozone values decrease as a function of distance from the lake. On page 46, Wisconsin presents a table of 14 ozone values from 15 monitors (one monitor in Racine has no data), with distance from lake ranging from 0.14 miles to 35 miles. On page 47, Wisconsin plots those 14 data points. Next, Wisconsin uses a power-fit function to find a curve that fits these data points (there is no explanation for why a power-fit curve, as opposed to some other curve, is most appropriate). However, that power-fit function is calculated using only 8 data points. I see no credible reason for excluding the other 6. At the top of page 47,

from this cherry-picked data, Wisconsin finds that "a consistent relationship exists between design values and distance inland along most of the lakeshore."

However, on the same page, Wisconsin immediately finds that its power-fit curve cannot apply to Kenosha, because both monitors in Kenosha have ozone values higher than this curve would suggest. On page 49, Wisconsin assumes that ozone values in Kenosha should instead be determined with a linear curve (there is no explanation for why a linear curve, as opposed to some other curve, is most appropriate).

The fundamental premise in Wisconsin's letter is that ozone values decrease as a function of distance from the Lake Michigan shoreline. At the latitude of Kenosha, there are actually 4 ozone monitors with increasing distance from the lake:

- the Chiwaukee monitor at distance 0.15 miles has ozone value 77 ppb,
- the Kenosha Water Tower monitor at distance 3.6 miles has ozone value 71,
- the Lake Geneva monitor at distance 35 miles has ozone value 70, and
- the Beloit monitor at distance 64 miles has ozone value 69.

The distance to the Beloit monitor is my own measurement, because Wisconsin excludes this data point from their table. Looking at these four data points, I might grant Wisconsin's premise that ozone values decrease as a function of distance from the lake, but I certainly cannot agree that the decrease is linear! Wisconsin claims that a linear curve would fit a 8 ppb decrease within 4 miles, but also a 1 ppb decrease over the next 31 miles? Furthermore, Wisconsin's linear curve is a result of cherry-picking only the first two data points, which predicts that values of 70 ppb will be achieved at a distance of 4.2 miles from the lake, which is not well-aligned with the fact that our monitor with value 70 ppb is sited 35 miles from the lake.

When I first adopted my puppy, he grew like a weed, but lately he is growing more slowly:

- at 8 weeks he weighed 10 pounds,
- at 9 weeks he weighed 14 pounds, and
- at 25 weeks he weighed 38 pounds.

Tomorrow Oskar will be 26 weeks - what should we expect him to weigh? Using a very lazy approach, I might assume that his growth is linear, and calculate linear growth using only the earliest two data points - discarding the most recent measurement. Using Wisconsin math, my 38 pound puppy will wake up tomorrow weighing 82 pounds!

I do not see a technical basis for agreeing with Wisconsin's statewide power-fit curve (because, among other reasons, data is cherry-picked) nor Wisconsin's linear Kenosha curve (because, among other reasons, data is cherry-picked, and the function is clearly nonlinear). Because Wisconsin's recommendation rests on these curves, I cannot find any technical basis for agreeing with Wisconsin's recommendation.

My above analysis rests on the application of simple math to the problem of ozone formation, but here I haven't explored whether Wisconsin's claims are grounded in ozone science. Jenny, you did your PhD in atmospheric chemistry; I would like to know your professional opinion regarding certain claims and assumptions in this letter:

- Is Wisconsin's analysis any more credible for areas further north?
- Wisconsin dismisses the possibility that its own emissions contribute to its own violations. Is there any technical basis to support this?
- Regarding the power-fit curve derived from cherry-picked data, Wisconsin's curve is not fitted to six data points, and Wisconsin provides only cursory explanations for why these points should not be expected to fit. These explanations involve direct transport of ozone near the Illinois border, "urban effects" over Milwaukee, and the impact of longer transport time to areas further north. Are these explanations consistent with our knowledge of ozone science? Do you agree with Wisconsin's premise that six data points ought not fit this curve, but the other eight can be assumed to fit?
- Wisconsin states that "a consistent relationship exists between design values and distance inland along most of the lakeshore" but later specifically excludes this analysis from applying to the lakeshore of most of Milwaukee. Is there any technical support for this?
- Do you broadly agree with my conclusions above? Am I missing any important context?

Eric